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CLAIMS

1. A leakage water cut-off agent comprising (a) a water-absorptive polymer dispersed without swelling in (b) a dispersing medium containing alkylene glycol derivatives having repeated units of 2 carbon atoms or more as the indispensable component.

2. A leakage water cut-off agent according to Claim 1 further comprising (c) a gellant of water-absorption polymer.

3. A leakage water cut-off agent according to Claim 1 or 2, wherein said gellant is a compound which can release a 2 or more valences of metal cation in water or has a cation-exchange capacity in water.

4. A leakage water cut-off agent according to Claim 1 or 2 further comprising a storage stabilizer.

5. A leakage water cut-off agent according to any one of Claims 1 to 4, wherein said water-absorptive polymer contains a highly water-absorptive polymer and a water-absorptive natural polymer.

6. A leakage water cut-off agent according to Claim 5, wherein said high water-absorptive polymer is at least one selected from the group consisting of poly (meth)acrylic acid derivatives, alginic acid derivatives, starch derivatives, poly-N-vinylacetamide derivatives, polyvinylalcohol derivatives and cellulose derivatives.

I. 1,4-9
II. 2+3 (I+gellant)
III. 10 making
IV. 11+12 infil in sponge
V. 13 article coated or infil
VI. 14 placed in leak pathway
VII. 16+17 injected into concrete

I
II
I
water-abs poly
sealing leakage

7. A leakage water cut-off agent according to Claim 5 or 6, wherein said water-absorptive natural polymer is at least one selected from the group consisting of alginic acid, sodium alginate and guar gum.

8. A leakage water cut-off agent according to any one of Claims 1 to 7, wherein said alkylene glycol derivatives comprise at least one selected from the group consisting of polyethylene glycol, polypropylene glycol and polybutylene glycol.

9. A leakage water cut-off agent according to any one of Claims 1 to 8 comprising water.

10. A method for manufacturing the leakage water cut-off agent according to Claim 9 characterized by that (a) said water-absorptive polymer is added to disperse in the agueous solution of (b) said alkylene glycol derivative having repeated units of 2 carbon atoms or more.

11. A leakage water cut-off material characterized by that the leakage water cut-off agent according to any one of Claims 1 to 10 is infiltrated in a spongy substance.

12. A leakage water cut-off material according to Claim 11, wherein said spongy substance is at least one selected from the group consisting of an urethane foam, a silicon resin foam, a synthetic rubber foam and a cellulose sponge.

13. A leakage water cut-off material comprising at least

one selected from the group consisting of string, rope, film, sheet, cloth, unwoven fabric and paper, which is coated or infiltrated by the leakage water cut-off agent according to any one of Claims 1 to 10.

14. A method for preventing water leakage characterized by that the water leakage preventive material according to any one of Claims 11 to 13 is placed to the water leakage pathway of a construction.

15. A method for preventing water leakage according to Claim 14, wherein said water leakage pathway is a joint surface or faying surface of concrete.

16. A method for preventing water leakage characterized by that the leakage water cut-off agent according to any one of Claims 1 to 10 is injected into the injecting holes set in a concrete construction.

17. A method for preventing water leakage according to Claim 16, wherein said injecting holes are set in zigzag along the both sides of a crack.

and that it absorbs substantially to swell only when it contacts with more than a certain amount of water. This finding led the completion of the present invention. Namely, the present invention relates to the followings.

(1) A leakage water cut-off agent comprising (a) a water-absorptive polymer dispersed without swelling in (b) a dispersing medium containing alkylene glycol derivatives having repeated units of 2 carbon atoms or more as the indispensable component.

(2) A leakage water cut-off agent according to the above item (1) comprising (c) a gellant of water-soluble polymer.

(3) A leakage water cut-off agent according to the above item (1) or (2), wherein said gellant is a compound which can release a 2 or more valences of metal cation in water or has a cation-exchange capacity in water.

(4) A leakage water cut-off agent according to the above item (1) or (2) comprising a storage stabilizer.

(5) A leakage water cut-off agent according to any one of the above item (1) to (4), wherein said water-absorptive polymer contains both a high water-absorptive polymer and a water-absorptive natural polymer.

(6) A leakage water cut-off agent according to the above

item (5), wherein said high water-absorptive polymer is at least one selected from the group consisting of poly (meth)acrylic acid derivatives, alginic acid derivatives, starch derivatives, poly-N-vinylacetamide derivatives, polyvinyl-alcohol derivatives and cellulose derivatives.

(7) A leakage water cut-off agent according to the above item (5) or (6), wherein said water-absorptive natural polymer is at least one selected from the group consisting of alginic acid, sodium alginate and guar gum.

(8) A leakage water cut-off agent according to any one of the above item (1) to (7), wherein said alkylene glycol derivatives comprise at least one selected from the group consisting of polyethylene glycol, polypropylene glycol and polybutylene glycol.

(9) A leakage water cut-off agent according to any one of the above item (1) to (8) further comprising water.

(10) A method for manufacturing the leakage water cut-off agent according to the above item (9) characterized by that (a) said water-absorptive polymer is added to disperse in the aqueous solution of (b) said alkylene glycol derivative having repeated units of 2 carbon atoms or more.

(11) A leakage water cut-off material characterized by that the leakage water cut-off agent according to any one of the above item (1) to (10) is infiltrated in a spongy substance.

(12) A leakage water cut-off material according to the above item (11), wherein said spongy substance is at least one selected from the group consisting of an urethane foam, a silicon resin foam, a synthetic rubber foam and a cellulose sponge.

(13) A leakage water cut-off material comprising at least one selected from the group consisting of string, rope, film, sheet, cloth, unwoven fabric and paper, which is coated or infiltrated by the leakage water cut-off agent according to any one of the above item (1) to (10).

(14) A method for preventing water leakage characterized in that the leakage water cut-off material according to any one of the above item (11) to (13) is placed to the water leakage pathway of a construction.

(15) A method for preventing water leakage according to the above item (14), wherein said water leakage pathway is a joint surface or a faying surface of concrete.

(16) A method for preventing water leakage characterized by that the leakage water cut-off agent according

to any one of the above item (1) to (10) is injected into the injecting openings set in a concrete construction.

(17) A method for preventing water leakage according to the above item (16), wherein said injecting openings are set in zigzag along the both sides of a crack.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 shows one example of a concrete container.

Fig.2 shows one of the bisecting pieces of the concrete container of Fig.1

Fig.3 shows a water leakage test container in which the two bisecting pieces of the concrete container of Fig.1 are fixed with a wire.

Fig.4 is a cross-section in the case that an opening for a leakage water cut-off agent is formed on a joint to waterproof.

The numbers given in those drawings show the followings:

1: Concrete container

2: Seam

3: Wire

4: Opening for injecting a leakage water cut-off agent

5: Heat-insulating material holding concrete

water-absorptive polymer having that of as high as several tens-hundreds times, may be used depending on their usages.

The high water-absorptive polymer include a (half-) synthetic polymer which includes poly(meth)acrylic acid derivatives such as a polyacrylic acid alkali metal salt, sodium (meth)acrylate-vinyl alcohol copolymers (methyl(meth)acrylate-vinyl acetate copolymer-saponificated products), poly(meth)-acrylonitrile polymer-saponificated products, a hydroxyethyl methacrylate polymer and poly(meth)acrylamide; cellulose derivatives such as carboxymethylcellulose alkali metal salt; polyacrylamide; alginic acid derivatives such as sodium alginate and propylene glycol alginate; starch derivatives such as sodium starch glycolate, sodium starch phosphate and a starch-acrylic acid salt graft copolymer; poly-N-vinylacetoamide derivatives such as a N-vinylacetoamide polymer; polyvinyl alcohol derivatives such as polyvinyl alcohol, polyvinyl formal and polyvinyl acetal. Among these highly water-absorptive polymers, poly(meth)acrylic acid derivatives are preferable. Sodium poly(meth)acrylate or carboxymethylcellulose (alkali metal salt) is especially preferable.

The term "a (half-) synthetic polymer" in this description shows any of a synthetic polymer and a half-synthetic polymer. The term "(meth)acrylic acid" shows any of acrylic acid and methacrylic acid.

The usable water-absorptive polymer having a lower swelling degree than the above polymer is a natural polymer which includes guar gum, alginic acid, sodium alginate, potassium alginate, *konjak*, agar, *funori*, gelatin and glue. Alginic acid, sodium alginate or guar gum is preferable. These may be used alone and, if used in combination with the above high water-absorptive polymer, gives a favorable result according to the case. One or more natural polymers are in some cases used in combination with one or more highly water-absorptive (half-)synthetic polymers to display an excellent waterproof effect against inorganic salt-rich water such as seawater. This combination is not limited to any particular one, but sodium polyacrylate or polyacrylic acid is preferable as the (half-)synthetic polymer to use in the combination, and alginic acid, sodium alginate or guar gum is preferable as the natural polymer to use in the combination. In the combination, the natural polymer is generally mixed in a rate of 20-1,000 parts, preferably 50-500 parts relative to 100 parts of the (half-)synthetic polymer.

such as polyethylene glycol, polyethylene glycol diglycidyl ether, polyethylene glycol aliphatic acid ester, a higher alcohol ethylene oxide adduct, alphaphenol ethylene oxide adduct, an aliphatic acid ethylene oxide adduct, a polyalcohol aliphatic acid ester ethylene oxide adduct, a higher alcoholamine ethylene oxide adduct, a fat ethylene oxide adduct or a polypropylene glycol ethylene oxide adduct: propylene glycol derivatives such as propylene glycol and a polypropylene glycol polyethylene glycol block polymer; and butylene glycol derivatives such as polybutylene glycol. Polyethylene glycol, polypropylene glycol and polybutylene glycol are preferable. These may be used alone or in combination of two or more.

The leakage water cut-off agent of the present invention can be obtained by adding to disperse the water-absorptive polymer under stirring in the dispersion medium containing the alkylene glycol derivatives having repeated units of 2 carbon atoms or more as the indispensable component.

The alkylene glycol derivatives, if they are liquid having a low viscosity, can be used alone, but if they are viscous liquid or solid such as wax, are preferably adjusted in the viscosity by adding water to use as a mix dispersion medium with water. The mix ratio of the

The gellant ((c)component) for gelatinizing the water-absorptive polymer(hereinafter simply called the gellant) is not limited to any particular one provided that it can bond chemically or physically with the water-absorptive polymer to gelatinize when the polymer absorbs water to swell or dissolve. The preferable compound is usually what can give 2 or more valent metal cations in water or can have a cation-exchange power in water. The gellant can be simply determined by observing whether the viscosity of the solution of a water-soluble polymer, which is dispersed or dissolved in water, increase or not after adding a test compound. Namely, an increase of viscosity would show that it has a gelatinizing ability, and no increase of viscosity would show the reverse.

A specific example of the gellant ((c)component) includes a polyvalent metal silicate, a water-soluble alkali-earth metal salt, an alum, a water-soluble aluminium salt, a water-soluble iron salt, a water-soluble manganese salt, a water-soluble zinc salt and an alkali-earth metal oxide, which can give their metal ions in water in amount enough to have the gelatinizing ability. The polyvalent metal silicate is an aluminium silicate, a calium silicate or the like, including a Ca type silicate salt (a silicate mineral)

such as bentonite, montmorillonite or smectite. The Ca type silicate salt (Silicate Mineral) such as bentonite, montmorillonite or smectite in the present invention means silicate salt having a relatively higher calcium content, which is preferably 1-2% by weight or more in terms of CaO relative to the whole weight of the bentonite, montmorillonite or smectite. The water-soluble alkali-earth metal salt includes the alkali-earth metal salt of a 1-3C organic acid, an inorganic acid or the like, for example, calcium acetate, calcium chloride, calcium nitrate, magnesium acetate, magnesium chloride, magnesium nitrate and magnesium sulfate. The alum includes aluminium potassium alum and an iron alum. The water-soluble aluminium salt includes aluminium lactate, aluminium acetate, aluminium chloride, aluminium sulfate, and aluminium nitrate. The water-soluble iron salt includes iron acetate, iron chloride, iron sulfate and iron nitrate. The water-soluble manganese salt includes manganese acetate, manganese chloride and manganese sulfate. The water-soluble zinc salt includes zinc acetate, zinc chloride, zinc nitrate and zinc sulfate. The alkali-earth metal oxide includes magnesium oxide and calcium oxide. The preferable one includes bentonite, montmorillonite, smectite, magnesium acetate, calcium acetate, aluminium lactate, aluminium acetate, and

aluminium sulfate.

The gellant is added in 0-4,000 parts, preferably 20-3,000 parts, more preferably 50-2,000 parts relative to 100 parts (by mass: hereinafter the same, unless otherwise stated) of water-absorptive resin.

The gel formed by the gellant closes water leakage sites such as hole, crack and crevice, and then no more flow away by dissolving in water because it is insoluble in water. Therefore, it is preferable.

The water-absorptive polymer, if it does not dissolve in water but absorbs water to swell into a gel for itself, does not always need a gellant.

A storage stabilizer ((d) component) is preferably used in the leakage water cut-off agent to suppress the change of its viscosity and increase its storage stability. The storage stabilizer is not limited to any particular one provided that it has an effect to prevent change of quality such as change of viscosity in the agent.

The causes of change of quality such as change of viscosity during the storage of the leakage water cut-off agent of the present invention considered as the decomposition of an organic substance in the agent by ultraviolet ray absorption, oxidation or infection of a bacteria or fungi. The substance that can prevent the organic substance from decomposition is useful as one of

EXAMPLE

The present invention will be described in details with reference to examples.

Example A1

(1) Polyethylene glycol 500g

(Reagent made by Kanto Kagaku KK, m.w.7,400-9,000)

(2) Water 500g

(3) Sodium polyacrylate 12.5g

(Trade name: Panakayaku-CP, made by NIPPON KAYAKU KK)

Polyethylene glycol (1) was gradually added to dissolve in water (2) under stirring. The water-absorptive polymer (3) was gradually added to disperse in the solution under stirring to obtain the leakage water cut-off agent of the present invention.

The measurement by the B type viscometer (made by Tokyo Keiki KK) showed that the leakage water cut-off agent had a viscosity of 1,030cP at 25℃.

Separately, the water-absorptive polymer (3) was added in water (2), and Polyethylene glycol (1) was then added in the solution to obtain the test sample, which was too highly viscous to measure the viscosity by the B type viscometer (made by Tokyo Keiki KK).

600g of water was added in 2.6Kg of the commercially-available sand-mixed cement (Trade name:

Example A3

(1) Polyethylene glycol 500g

(Reagent made by Kanto Kagaku KK, m.w.7,400-9,000)

(2) Water 500g

(3) Carboxymethyl cellulose 15.5g

(Trade name:CMC Daicel, made by Daicel Chem. Ind .KK)

Polyethylene glycol (1) was gradually added to dissolve in water (2) under stirring. The water-absorptive polymer (3) was gradually added to disperse in the solution under stirring to obtain the leakage water cut-off agent of the present invention.

The measurement by the B type viscometer (made by Tokyo Keiki KK) showed that the leakage water cut-off agent had a viscosity of 1,030cP at 25℃.

Separately, the water-absorptive polymer (3) was added in water (2), and Polyethylene glycol (1) was then added in the solution to obtain the test sample, which was too highly viscous to measure the viscosity by the B type viscometer (made by Tokyo Keiki KK).

The same container as in Example A1 was filled up with the leakage water cut-off agent of the present invention, left for 30 minutes and emptied of the agent. The container was filled up with water again, and leaked no water through the joint. The container filled up with

(1) Polyethylene glycol 100g

(Reagent made by Kanto Kagaku KK, m.w.7,400-9,000)

(2) Water 100g

(3) Bentonite 28g

(Trade name:Benclay, made by Mizusawa Chem.Ind.KK)

(4-1) Sodium polyacrylate 1.5g

(Trade name:Panakayaku-CP, made by NIPPON KAYAKU KK)

(4-2) Hydroxypropyl methyl cellulose 2.5g

(Trade name: Metholose, made by Shinetsu Chem.Ind.KK)

Polyethylene glycol (1) was gradually added to dissolve in water (2) under stirring. The water-absorptive polymers (4-1)and (4-2) were gradually added to disperse in the solution under further stirring, followed by adding the gellant (3) under stirring to obtain the leakage water cut-off agent of the present invention.

The measurement by the B type viscometer (made by Tokyo Keiki KK) showed that the leakage water cut-off agent had a viscosity of 970cP at 25℃.

800g of water was added in 3.0Kg of the commercially-available sand-mixed cement (Trade name: Aso Katei Cement, made by Aso Cement KK) to mix thoroughly, followed by packing in a framework to solidify into the shape as shown in Fig.1.

This concrete container was bisected (as in Fig.2),

(Reagent made by Kanto Kagaku KK, m.w.7,400-9,000)

(2) Water 130g

(3) Smectite 30g

(Trade name:Synthtic smectite, made by Cope Chem.KK)

(4-1) Sodium polyacrylate 1.8g

(Trade name:Panakayaku-CP, made by NIPPON KAYAKU KK)

(4-2) Polyvinyl alcohol 0.5g

(Trade name: RS-117, made by KK Kurare)

Polyethylene glycol (1) was gradually added to dissolve in water (2) under stirring. The water-absorptive polymers (4-1) and (4-2) were gradually added to disperse in the solution under further stirring, followed by adding to dissolve the gellant (3) to obtain the leakage water cut-off agent of the present invention.

The above leakage water cut-off agent 12g was infiltrated into an urethane sponge (2.5cm × 2.5cm sectional×12cm long; density:0.25g/cm^3) and then dried at 50℃ for 24 hours to obtain the water leakage preventive material of the present invention.

Separately, a concrete cracked container was prepared as in Example E1 so that the joint might have a gap of 1.6-0.8cm in the bottom. The container was returned to the bisection state. The above water leakage preventive material was put between the bottom surfaces of the joint, and an oily coking material(Trade name:

(4) Sodium polyacrylate 2.5g

(Trade name:Panakayaku-CP, made by NIPPON KAYAKU KK)

(5) Sodium alginate 2.5g

(Trade name: Kimitsu algine, made by Kimitsu Chem.Ind.KK)

(6) Silicasol 30g

(colloidal silica dispersion solution)

(Trade name: Snowtex30, solid: 30% by weight, made by Nissan Chem. Ind. KK)

(7) Sorbic acid (fungicide) 0.5g

(Reagent, made by Wako Junyaku Ind.KK)

Polyethylene glycol (1) was gradually added to dissolve in water (2) under stirring. The water-absorptive polymers (4) and (5) in order were gradually added to disperse in the solution under stirring, followed by adding the silicasol(6) and further the gellant (3) under stirring, to obtain A solution (a leakage water cut-off agent of the present invention containing no storage stabilizer).

Separately, the fungicide (7) was added in the A solution as prepared by the above process to obtain B solution which is a leakage water cut-off agent of the present invention containing a storage stabilizer.

The measurement by the B type viscometer (made by Tokyo Keiki KK) showed that both the A solution and the B solution had a viscosity of 1,540cP at 25℃.

(4) Sodium polyacrylate 2.5g

(Trade name:Panakayaku-CP, made by NIPPON KAYAKU KK)

(5) Guar gum 2.5g

(Trade name: Guar gum, made by Organo KK)

(6) Silicasol 30g

(colloidal silica disperse solution)

(Trade name: Snowtex30, solid:30% by weight, made by Nissan Chem. Ind. KK)

(7) o-phenyl phenol (fungicide) 0.5g

(Reagent, made by Kanto Kagaku KK)

Polyethylene glycol (1) was gradually added to dissolve in water (2) under stirring. The water-absorptive polymers (4) and (5) were gradually added to disperse in the solution under further stirring, followed by adding the silicasol(6) under stirring and further adding the gellant (3) and stirred to obtain A solution (a leakage water cut-off agent of the present invention containing no storage stabilizer).

Separately, the fungicide (7) was added in the A solution as prepared by the above process to obtain B solution which is a leakage water cut-off agent of the present invention containing a storage stabilizer.

The measurement by the B type viscometer (made by Tokyo Keiki KK) showed that both the A solution and the B solution had a viscosity of 1,280cP at 25℃.

(Trade name:Benclay, made by Mizusawa Chem.Ind.KK)

(4) Sodium polyacrylate 2.5g

(Trade name:Panakayaku-CP, made by NIPPON KAYAKU KK)

(5) Agar 2.5g

(Trade name: Ina agar, made by Ina Food Ind.KK)

(6) Silicasol 30g

(colloidal silica dispersion solution)

(Trade name: Snowtex30, solid:30% by weight, made by Nissan Chem. Ind. KK)

(7) Thiabendazol (fungicide) 0.5g

(Reagent, made by Tokyo Kasei Ind.KK)

Polyethylene glycol (1) was gradually added to dissolve in water (2) under stirring. The water-absorptive polymers (4) and (5) were gradually added to disperse in the solution under further stirring, followed by adding the silicasol(6) under stirring and further adding the gellant (3) to obtain A solution (a leakage water cut-off agent of the present invention containing no storage stabilizer).

Separately, the fungicide (7) was added in the A solution as prepared by the above process to obtain B solution which is a leakage water cut-off agent of the present invention containing a storage stabilizer.

The measurement by the B type viscometer (made by Tokyo Keiki KK) showed that both the A solution and the